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Transposition Flaps in the Reconstruction of Auricular Defects after MOHS Micrographic Surgery

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Rezumat

Lambouri de transpoziție utilizate în reconstrucția defectelor auriculare rămase în urma chirurgiei MOHS

Închiderea defectelor localizate la nivelul urechii poate fi o provocare chirurgicală semnificativă, din cauza structurii cartilaginoase tridimensionale complexe a acestei regiuni.
Pacienți şi rezultate: Vă prezentăm o serie de 5 cazuri retrospective, ale unor defecte auriculare, rămase în urma exciziei cancerelor de piele prin microchirurgie Mohs, care au necesitat închidere utilizând lambouri de transpoziție şi particularitățile acestora.
Discuții şi concluzii: Există diverse proceduri chirurgicale descrise pentru reconstrucția unui defect al urechii, precum, lambouri, grefe de piele şi chiar vindecarea per secundam. În opinia noastră, lambourile de transpoziție pot fi o opțiune bună atunci când defecte sunt localizate la nivelul tragusului, concai, fosei triunghiulare, părții superioare a helixului sau chiar părții mediale a urechii. Acest tip de lambou permite reconstrucția într-o singură etapă chirurgicală cu morbiditate scăzută şi rezultate cosmetice favorabile.

Cuvinte cheie: lamboul de transpoziție, lambou tunelizat, micorchirurgie Mohs, cancer de piele, defecte ureche

Abstract

Background: Closing of ear defects can be a significant surgical challenge, due to the complex three-dimensional cartilaginous structure of this region.
Patients and Results: We present a series of 5 retrospective cases

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of defects on the ear, left after Mohs micrographic surgery for skin cancer, that were repaired with transposition flaps and their
Discussions and Conclusion: There are various surgical procedures described for the reconstruction of an ear defect, including local flaps, skin grafts, and even healing by secondary intention. In our opinion, transposition flaps can be a good option when dealing with defects of the tragus, chonca, triangular fossa, superior part of the helix, or even the medial part of the ear. It allows for reconstruction in a single surgical step with decreased morbidity and favorable cosmetic results.

Key words: transposition flaps, tunneled flaps, Mohs micrographic surgery, skin cancer, ears defects

Introduction

The fibrocartilage structure that composes the external ear provides mechanical support, and elasticity, gives the ear its complex three-dimensional shape – forming all the components of the auricle, namely helix, antihelix, scapha, concha, triangular fossa, tragus, and antitragus. The lobule is the exception, being composed of fibrofatty tissue.

The skin that coats the anterolateral surface of the ear lacks subcutaneous tissue and it is tightly adherent to the underlying perichondrium (1). The posteromedial part of the ear has some subcutaneous fat and the skin is looser, therefore making it a perfect donor site for both skin grafts and flaps (2).

When we deal with an ear defect, we have to think of not only the aesthetic result but also the functional role of the external ear (Ex the upper part of the helix provides support for the glasses or masks)(3). Also, inadequate coverage of the cartilage can lead to infections and chondrodermatitis, which can be extremely painful (3). In addition to this, we have to remember that the ear is a frequent site for keloid and hypertrophic scar formation (4).

On the other hand, the patient's age, comorbidities, and prognosis must be considered as well when planning the reconstruction.

Non-melanoma skin cancers tend to prefer chronically sun-exposed body parts like the lateral and superior parts of the ear. Complete surgical excision with tumor-free margins (Mohs micrographic surgery) remains the gold standard for treating both basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) located on the ear as this is a high-risk region (5,6).

Mohs micrographic surgery has the advantage of being a single-day, outpatient procedure. The tumor is excised, mapped, and processed in frozen horizontal sections which are available for immediate histologic evaluation. If tumoral tissue is found, then the procedure is repeated until the tumor is completely removed (7). Evaluation of 100% of the surgical margin allows for exceptional cure rates, with maximal conservation of normal tissue. This gives the possibility to close the defect in the same day, by using a flap.

We report a series of 5 retrospective cases of defects on the ear, left after Mohs micrographic surgery for skin cancer, that were repaired with transposition flaps and their particularities.

Surgical Technique

When dealing with a cartilage-exposed defect that is too large to be closed primarily without distorting the auricle, we may think about a transposition flap.

Transposition is the most common method of transferring tissue for skin defects on the head and neck. The principle of a transposition flap is to redirect and redistribute tension by moving an area of laxity over an adjacent area in need. The prototype of this flap is the rhombic flap, but other variations are the banner flap, the bilobed flap or the Z-plasty (double opposing transposition flaps) (3).

When designing the rhombic flap, first the

lesion is surgically excised as a rhombus with two opposing 60-degree angles and two opposing 120-degree angles. The flap is designed by extending the line of the short diagonal a length equal to the diagonal. This gives us a smaller secondary defect as well as four possible flap arrangements, allowing us to select the orientation that produces the ideal wound closure with low scar tension (2).

The flap should be undermined superficially in the subdermal plane, in order to ensure perfusion, and lifted into the primary defect. After wide undermining of the primary and secondary peripheral defect edges, the secondary defect should be closed first. After that, the flap should then be sutured into the primary defect.

When performing a tunneled flap, it is critical to ensure that the flaps and the pedicles are of the appropriate length to compensate for the tunneling. However, it is equally important that the creation of a tunnel through the cartilage is suitable for the width and thickness of the flaps (8).

To enable a single-stage execution, the portion of the flaps beneath the tunnel must also be de-epithelialized. The donor site is usually primarily closed and sutures are removed 7 days after the surgical procedures.

Subjects and Results

We present a series of 5 consecutive cases of defects on the ear, after Mohs micrographic surgery for skin cancer, that were repaired with transposition flaps and their particularities. All five patients underwent reconstruction with transposition flaps for ear by dermatologic MOHS surgeons from Dr Leventer Centre, Bucharest. They were followed-up at 2 and 6 months. There have been no significant complications in this series, and patient's acceptance of the results have been excellent.

This retrospective case series was approved by the Review Board at Dr Leventer Centre. All patients signed an informed consent and they have been informed about the publication of photos and medical history.

Case 1. A 69 years old man presented in our department with an erythematous patch that was present for many years. The lesion was covered with crusts and scales, slight infiltrating the left helix, antihelix, and there was an erosion of the dorsal face of the left helix, previously treated with topical antibiotics. Shave biopsy was performed that revealed a bowenoid type invasive squamous cell carcinoma.

The patient underwent Mohs microsurgery excision of the carcinoma located at the helix and antihelix. The final defect had dimensions of 48/49 mm which included: the skin defect at the level of helix, antihelix, and scapha. Altered peri-chondrium was visible at the level of scapha and antihelix, cartilaginous defects of helix and scapha were also noted.

V-shaped cartilage excision was performed with the apex at the level of the antihelix followed by interrupted stitches of the cartilage with 5.0 resorbable sutures.

Two types of flaps were used to cover the integumentary defect:

- tunneled preauricular transposition flap;
- mastoid cutaneous pedicled flap.

To create the tunneled preauricular transposition flap the first step was to measure and mark the flap along the preauricular area, dissecting it starting from the distal edge above the superficial temporal vessels. This was followed by proximal de-epithelization of the flap and the creation of the tunnel at the root level of the helix. The final step is transposition of the flap through the tunnel to cover the defect in the antihelix region and closure of the pre-auricular donor area with 5.0 non-absorbable wires (*Fig. 1*).

The remaining defect of the helix and scapha was covered using the pedicled mastoid flap. To perform this flap, the length of the skin defect was measured followed by incision and subcutaneous undermining of the flap. We noted the need for a viable flap long enough to avoid excessive tension at the time of suturing. Meticulous hemostasis was performed by electrocautery and interrupted stitches with 5.0 non-absorbable sutures. Pedicle sectioning was performed in two stages, 2 weeks after surgery. (*Fig. 2, Fig. 3*).

Case 2. The second case was a 79 years old

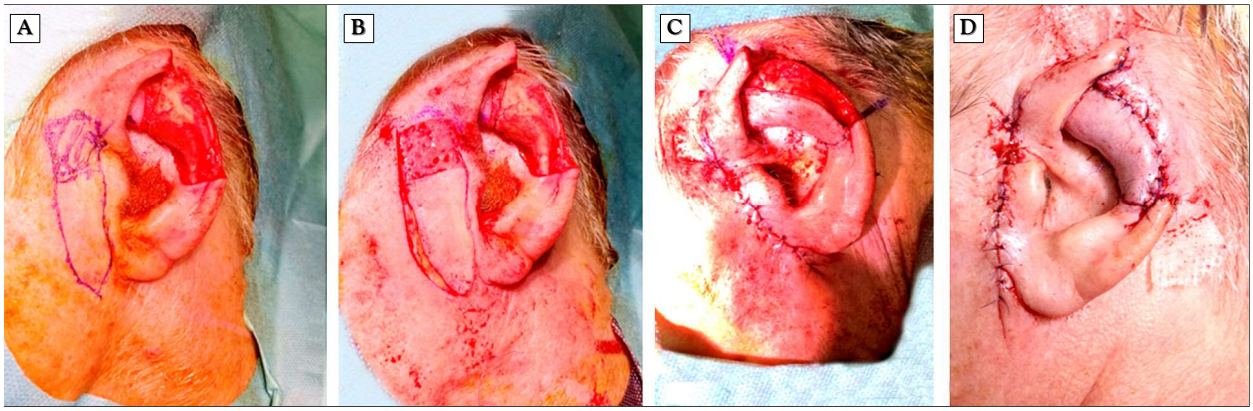

Figure 1. Design of the flap in the preauricular and mastoid region (A). Preauricular flap dissection preserving a superior pedicle (B). The preauricular flap was pulled throught the root level of the helix (C). Flaps and donor site sutured (D)

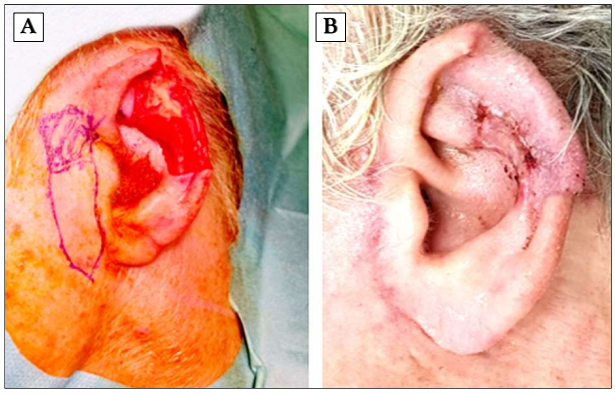

Figure 2. Initial defect after Mohs micrographic surgery for Bowenoid squamous cell carcinoma (A). Two months postoperative photograph (B).

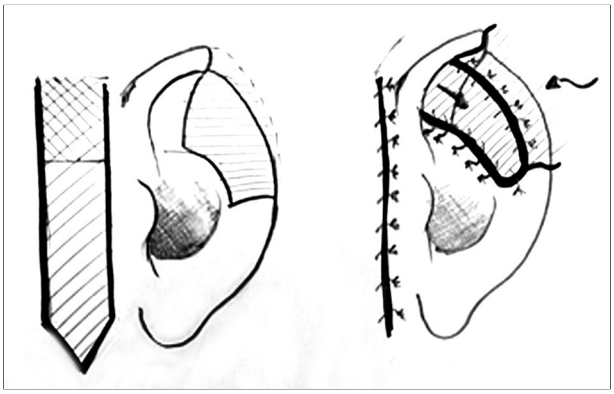

Figure 3. Reconstruction of an anterior defect using preauricular flap

female patient with a nodular basal cell carcinoma of the tragus. After complete excision of the skin tumor by Mohs micrographic surgery a skin and cartilage defect was created in the tragus of the left ear that extended in the external auditory canal. The final defect measured 14/8 mm, for which a transposition flap with an upper base in the preauricular region was used. In order to create this flap, the necessary measurements were taken so that the flap would also cover the defect in the external auditory canal. The flap was lifted and positioned at the level of the defect and then fixed with wires at separate points. The donor site defect was closed with a continuous wire (*Fig. 4, Fig. 5*).

Case 3. A 65 years old man confirmed with a well-differentiated squamous cell carcinoma located at the root of the right helix presented in our clinic to perform Mohs micrographic surgery.

The final skin defect measured 21/7 mm at the root of the helix for which a preauricular skin flap with a superior base was designed, dissection was performed starting from the distal edge followed by transposition of the flap to the skin defect (*Fig. 6*). The closure was performed with a continuous suture with non-absorbable sutures.

Case 4. A 76 years old female presented for Mohs excision of a basal cell carcinoma located in the lower portion of the concha with extension into the external auditory canal. After excision, a skin defect at the level of the concha with dimensions of 13/14 mm remained. A flap was created at the retro-

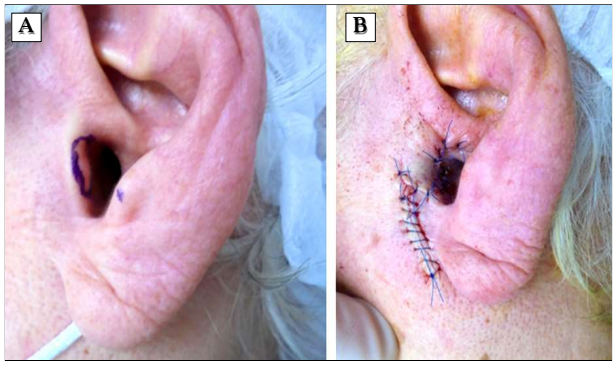

Figure 4. Marked basal cell carcinoma located on the tragus and external auditory canal (A). Preauricular transposition flap sutured in place (B)

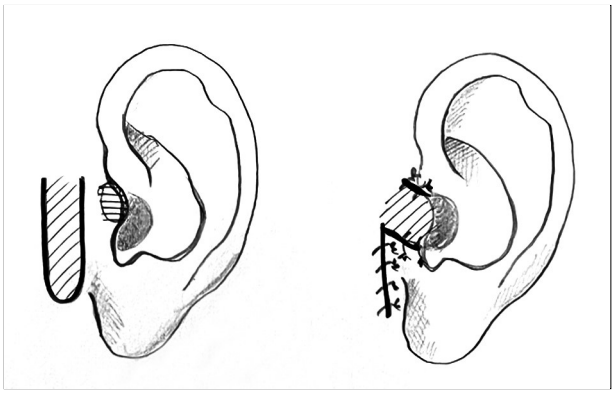

Figure 5. Reconstruction of the tragus. Elevation of the preauricular flap and closure of the defect

auricular level which was passed through a window in the conchal cartilage. The area of passage of the flap through the cartilage window was de-epidermized (*Fig. 7*). The flap was sutured with interrupted sutures and the donor area was closed primarily (*Fig. 8*).

Case 5. The last case was a 62 years old female with a skin defect in the region of the left lower concha with dimensions of 16/17 mm following Mohs microsurgery excision of a nodular basal cell carcinoma. For reconstruction a flap was designed in the retroauricular region, followed by local anesthesia and flap dissection. An incision was made on the posterior aspect of the upper concha to create a window through which the flap was passed, followed by adaptation of the flap to the defect while preserving its natural curvature (*Fig. 9*).

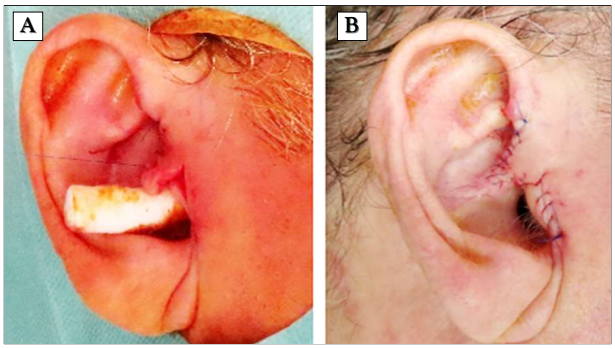

Figure 6. Lifted and positioned preauricular flap (A). Closure with continuous suture of the donor site and the flap (B)

Finally, the flap and donor site were closed. This type of reconstruction is known as a "flip-flop flap" (9) (Masson 1972), which offers a satisfactory cosmetic result in a single step (*Fig.10, Fig.11*).

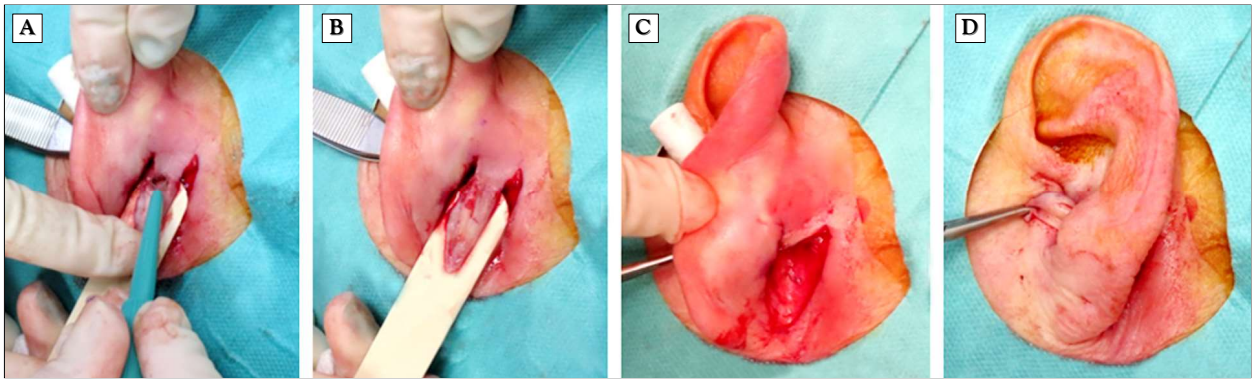

Figure 7. De-epidermizing the area of the flap that will pass through the tunnel (A).(B). Advanced through a tunnel created in the conchal cartilage, retroauricular view(C) anterior view (D)

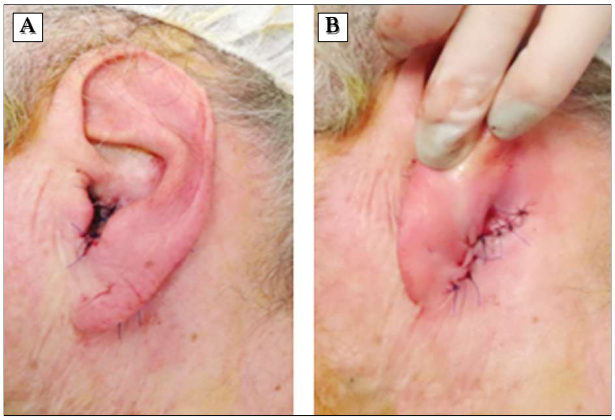

Figure 8. Retroauricular pull-through flap sutured in place, anterior view (A) retroauricular view (B)

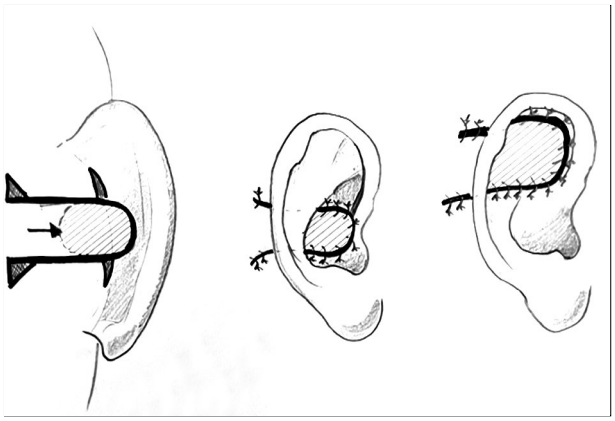

Figure 9. Reconstruction of the anterior defect using a pull-trough island flap

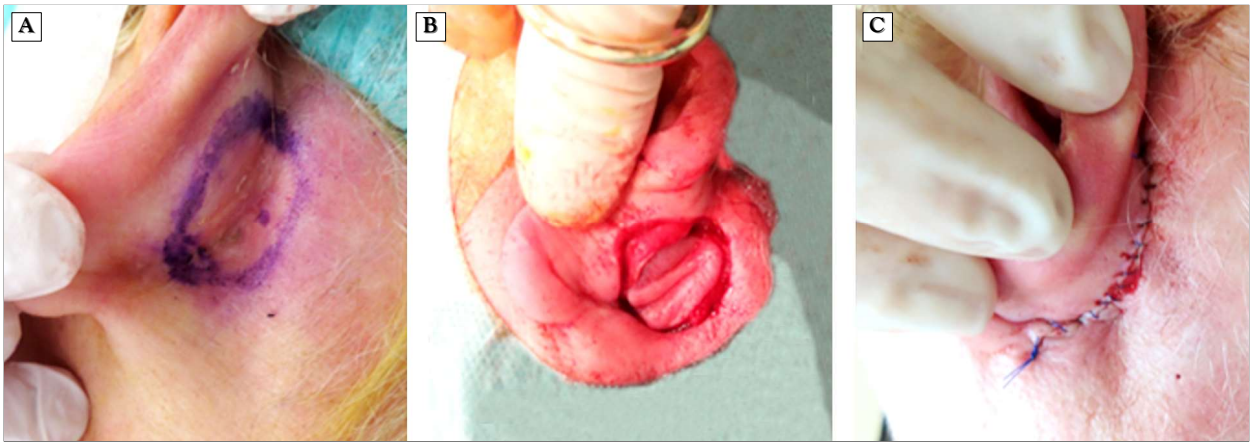

Figure 10. Designed flap in the retroauicular region(A). Flap dissection and window created on the upper concha through wich the flap passes (B). Sutured donor site (C)

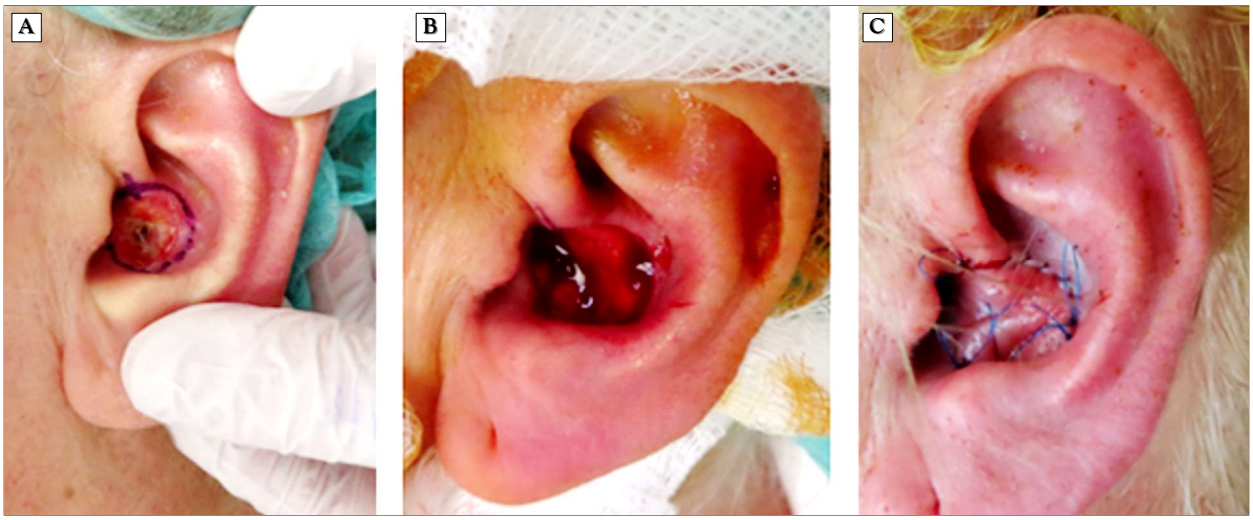

Figure 11. Nodular basal cell carcinoma of the left lower concha marked for Mohs micrographic surgery (A). Final skin defect of the concha (B). Flip-flop flap sutured in place (C)

Discussions

Closing defects on the auricle can be a significant surgical challenge, sometimes even for small defects. The complex three-dimensional cartilaginous structure of the ear, the thin stretched rich vascularized skin that covers the anterolateral part of the ear, and the quality of the surrounding skin - all add to the difficulty and ingenious way of the reconstructions in this area (1,2).

Many techniques have been described for reconstruction of the helix due to this part of the auricle frequently being affected by skin cancer and trauma. Small defects of the helical rim can be closed directly and larger ones by using advancement flaps – either by simple advancement or double rotation-advancement flap (Antia-Buch) (2,3,4).

When dealing with a cartilage-exposed defect that is too large to be closed primarily without distorting the auricle, we may think about a transposition flap.

First described by Pennisi et al (10) for earlobe reconstruction, preauricular transposition flaps (banner flaps) can be also used for defects on the tragus, the superior margin of the helix, the antitragus, or they can be pulled through the helix to cover defects on the triangular fossa or scapha (4). The possibility to be based either superiorly or inferiorly contributes to its increased versatility (8).

Posterior tunneled transposition flaps ("flip-flop flaps") are very useful for defects on the concha or antihelix and are suitable to be performed under local anesthesia. The flaps are usually deepithelialized and tunneled through a cartilage window into primary surgical defects, where they are sutured to adjacent tissue.

Transposition flaps have several advantages. They redistribute and redirect tension, assisting in closure of defects that would otherwise be closed under unacceptably high tension or would distort a nearby anatomical structure, leading to functional or aesthetic impairment (11). They provide better results than skin grafts and can be very useful when the perichondrium has been removed (4).

A disadvantage of using a transposition flap is the potential of developing a "pin cushion" appearance, usually in the first 3 months postoperatively. It can be aggravated by insufficient tissue undermining, an oversized flap or a curvilinear incision when designing the flap. "Pin cushion" deformities are more likely to occur when the flap is superiorly based and the lymphatic drainage pathways are interrupted by the incision. Fortunately, this usually resolves with time or with intralesional steroid injection (2).

Besides local flaps, two other options are available for closing full-thickness auricular skin defects: healing by secondary intention or skin grafts. Secondary healing is usually a long process and exposure of the cartilage can lead to infections and chronic chondritis (2). Alternatively, skin grafts may be used although the color tends to be poorly matched, leading to an inferior aesthetic result. Furthermore, removal of the cartilage can lead to important changes in the structural support of the ear and can cause some degree of distortion due to the absence of an underlying frame which may cause contracture of the skin graft. This can be especially true for defects located at the antihelix, antitragus, triangular fossa, and scapha (12).

The method we used for closing the defects presented in our series of cases had a simple concept (using the excess skin on the surrounding areas to close problematic subunits of the ear – e.g. tragus, antitragus, triangular fossa, concha or scapha), was a relatively easy surgical technique to master, and had little to no complications during our follow-ups at 2 and 6 months. Also patient's acceptance of the results had been excellent.

Conclusion

There are various surgical procedures described for the reconstruction of an ear defect, including local flaps, skin grafts, and even healing by secondary intention. In our opinion, transposition flaps can be a good option when dealing with defects on the tragus, concha, triangular fossa, superior part

of the helix, or even the medial part of the ear, because it allows for reconstruction in a single surgical step with decreased morbidity and favorable cosmetic results.

Author's Contributions

Anita Barcan and Irina Nasturica have equal contributions to the article.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Approval

The authors have received the approval of the Ethics Committee of Dr Leventer Centre.

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